

REMARKS

Claims 1-35 are pending and stand rejected. Claims 1, 9, 12, 15, 21, 27, 30 and 31 have been amended. Reconsideration is respectfully requested.

A. Rejection of Claims 1-35 Under § 103(a)

Claims 1-35 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,115,289 to Hisamoto et al. ("Hisamoto") in view of U.S. Patent 6,580,124 to Cleeves et al. ("Cleeves"). Applicant respectfully traverses this rejection as explained below:

The Examiner admits that Hisamoto does not disclose a control gate disposed over the third section of the folded floating, but states that it would have been obvious to form a control gate as taught by Cleeves et al. as set forth in col. 9, lines 18-27, and Fig. 2q of 6,580,124.

The Applicant respectfully submits, however, to the Examiner that the gate 30 of device disclosed by Hisamoto functions differently from the floating gate 20 of the present invention, and sees it be further helpful to emphasize the difference on device between this invention and 5,115,289 to Hisamoto, as described below:

In Hisamoto's device, the gate 30 functions as gate for field-effect type transistor (col. 6, lines 49-52) and is electrically connected to an external terminal (as shown in FIG.1 in cross section), whereas the floating gate 20 of the present invention is floating (i.e. not connected to any external terminal) and is capacitively coupled by a control gate (see p. 54, lines 24-27). As a result, Hisamoto's device is limited to volatile memories (e.g. Static Random-Access-Memory SRAM and Dynamic Random-Access-Memory DRAM: col. 17 Lines 12-13 and 37-38 in 5,115,289) and cannot be used for non-volatile memory. Further, the gate 30 of Hisamoto's device is not structured to the device itself and can be shared with other devices adjacent thereto (see, for example, FIG. 3a and 3b), whereas the floating gate 20 of the present invention is structured to each individual memory cell entirely and cannot be shared (see FIG. 1A of the present invention, wherein the floating gate does not extend to the edge of the drawing as the gate 30 does in FIG. 1 of 5,115,289).

Therefore, due to the difference on function and on structure, forming the Cleeves control gate over the gate 30 of the Hisamoto device will not result in a non-volatile memory (as recited in claim 1, 21, and 31).

The Applicant further respectfully submits, however, that the floating gate Examiner identified in Fig. 2q, which can be better captured in Fig. 2r, does not have a structure on its cross-section folding around the silicon block (or pillar 102). Specifically, the floating gates (i.e. the charge storage mediums 218, and 234 in Fig. 2r) as taught by Cleeves fail to result in the structure recited in claims 1-35, as explained further below:

Cleeves taught the charge storage mediums (e.g. 114, 115, 116, and 117 in Fig. 1c or 218, and 234 in Fig. 2r) for charge storage. These mediums are disposed over the channel for electrically screening the control gate and the channel region addressed by the control gate (see e.g. col. 3, lines 9-11), and thus have the same function as the floating gate of the present invention. The storage mediums are structured in 4 sections disposed around the pillar (silicon block) and are physically disconnected and/or electrically isolated from each other (as shown in FIG. 1c and FIG. 1b for mediums 114, 115, 116, 117, and in FIG. 2r for mediums 218, and 234) to permit different amounts of charge be stored in each charge storage medium (col. 3, lines 57-60). Therefore, each of the storage medium functions as a separate floating gate to result in 4 “floating gates” in each cell. In fact, the embodiments in Cleeves art rely on nonconductive material (e.g. dielectrics, see col. 7, lines 18-20 and lines 31-34) or on noncontinuous conductive nanocrystals (col. 7, lines 34-36) for these “floating gates” to work. Further, each of such “floating gate” has a rectangular shape (not a folded shape) and is disposed adjacent to one face of the pillar 102 (or silicon block) (see Fig. 1c, 1b), and does not have the three sections taught in the present invention as recited in claims 1, 21 and 31. Similar structure and argument apply to charge storage mediums 218, and 234 in Fig. 2r.

In a clear contrast, the present invention taught an electrically conductive floating gate having three sections connected in one piece to form the folded floating gate folding around silicon block 40a (see Fig. 1A, p. 9, lines 20-21 and lines 25-29 of the present invention). Since the floating gate is one piece of electrically conductive gate, charges stored thereon are evenly distributed through out different sections of the floating gate. Such floating gate is fundamentally different than that of Cleeves’ art, as different amounts of charge here cannot be stored in different sections of such floating gate (due to structural difference).

Cleeves further taught that adjacent to and in direct contact with each charge storage medium (e.g. 114-117) is a separate independently controllable control gate 118, 119, 120, and 121 as shown in FIG. 1c (see col. 2, lines 66-67, and col. 3, line 1) that can be separately probed

to determine whether or not charge is stored in each associated charge storage medium (col. 3 lines 48-50). Having the fundamental difference on floating gate described above, it is however not obvious on which section of the folded floating gate should the control gate be disposed over in view of the 4 control gates in cell taught by Cleeves. Therefore, Cleeves' art does not result in a structure where "a control gate is disposed over the third section of the folded floating gate" as recited in claims 1, 21 and 31.

Moreover, the present invention further teaches another embodiment (see Fig. 1D) having an additional gate 10 disposed over the control gate 15, which is over a folded floating gate. Therefore, adding the Cleeves control gate over the gate 30 of the Hisamoto device will not result in the non-volatile memory as recited in claim 7, 11, 13, 18, 20, 25, 29, and 35.

For these reasons, it is respectfully submitted that claims 1, 21 and 31 (and claims 2-20, 22-30, and 32-35 dependent thereon) are not rendered obvious by Hisamoto in view of Cleeves.

It is therefore requested that the rejection of claims 1-35 under § 103 be withdrawn.

For the foregoing reasons, it is respectfully submitted that the claims are in an allowable form, and action to that end is respectfully requested.

Respectfully submitted,